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Vol. IV January, 1904 No. 1

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F. W. BUTTERMANN, M. D.
EDITOR

C. H. TREADWELL, B. S.
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F. W. BUTTERMANN, M.D. . . . . EDITOR
Radiographer and Radiotherapeutist St. Joseph Hospital, Chicago.
C. H. TREADWELL, B.S. . MANAGING EDITOR

⁂

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THIS JOURNAL IS DEVOTED ENTIRELY TO ALL BRANCHES OF ELECTRO-THERAPEUTICS

⁂

Contributions of actual experience by physicians using the X-Ray as a therapeutic agent are highly valued by this journal, and the editor is always willing to reserve space for such communications.

Fire

TO OUR READERS:

We have lost our entire equipment for the journal and our present issue has therefore been delayed, but the journal will continue without interruption. Because of this great loss we ask all our readers and friends who are behind with their payments on subscriptions to remit as early as possible.

Yours truly,
ARCHIVES OF ELECTROLOGY AND RADIOLOGY.
Formerly AMERICAN ELECTRO-THERAPEUTIC
AND X-RAY ERA

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Archives of Electrology and Radiology

Vol. IV January, 1904 No. 1

Original Contributions.

DANGERS OF THE X-RAY OPERATOR.*

BY JOHN T. PITKIN, M. D.

For purposes of study let us divide the action of the rays of Roentgen upon the operator, into four arbitrary stages:

(1) Preparatory stage or stage of first impression.
(2) Premonitory or threatening stage.
(3) Stage of inflammation and disintegration.
(4) Stage of chronic skin diseases, etc.

PREPARATORY STAGE, OR STAGE OF FIRST IMPRESSIONS.

As you are all well aware, the operator receives no warning from the tube, experiences no sensations while being injured. After a time there is a little change of color of his hands and face. This he may erroneously attribute to the action of the solar rays.

> "His face is like the tan."
> (Longfellow, in the Village Blacksmith.)

A few papules or postules with itching here and there or bran-like scales to a local skin trouble (prurigo, acne or pruritus), a little swelling of the hands and features to a circulatory disturbance, the falling out of his hair to senility, when in reality they are caused by the Roentgen rays which are rendering the integument more and more susceptible to their action. Such symptoms should be looked upon as harbingers of an impending storm.

During a long period of increasing susceptibility, the operator may imagine himself an X-ray immune. As if by some special dispensation, he, like Shadrach, Meshach and Abednego, can walk in the fiery furnace (of the X-ray field) and not be burned.

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*Continued from December issue.

PREMONITORY OR THREATENING STAGE.

The symptoms of this stage are itching, warmth, local diaphoresis, a mild seborrhea, partial anaesthesia, luxuriant or deciduous hair (in hirsute people, the shedding of the hair may be the first indication of the rays' effects), cutis ancerina (goose skin), very small shot-like bodies in the cuticle, a glossy appearance of the parts as if they had been varnished, oedematous swelling of the subcutaneous cellular tissue, causing the hands and face, to become puffy as they do in Bright's Disease, rendering the fingers and palm of the hand stiff and awkward, effacing anatomical markings and giving a general rotundity of contour. Punctate red spots, a few and scattered (discreet) or many and close together (confluent) in groups, patches or diffuse; some are raised, others on a level with the surface. They may cause the skin to become as rough as the surface of a nutmeg grater. Some of the minute elevations may be colorless. They can be seen by looking at the parts obliquely. They can also be discerned by careful palpation. There is a flushed look to the skin about them.

DISCOLORATION OF THE SKIN.

Red, reddish-blue, yellow, brown or black. The first two colors, due to vascular charges, may or may not disappear. The others always remain on pressure. Pigmented portions of the body are especially affected with pigmentation. The same is true of dark individuals. It is by keeping diseased parts of the patients who have malignant ailments in this stage of irritability, oedema, tanning or redness and partial anaesthesia, that the greatest number of cures can be effected. From this stage the operator may recover, with or without desquamation. Exclusion of all parts of actinic rays, a good sweating of the parts, and crowding all the other emunctories, will help to restore the parts. Otherwise, as the result of further exposure, an operation or an accident, such as a blow or cut, to the irritated parts, the process will slowly, insiduously merge into the stage of chronic inflammation, with its "cardinal signs, calor, dolor, ruber, tumor and functio laessae" (quotation from lectures of Dr. Roswell Park, on Inflammation).

STAGE OF INFLAMMATION AND DISINTEGRATION.

The pathognomonic symptoms of X-ray inflammation as experienced by myself after seven years' exposure in the X-ray field, were extreme itching with constant desire to rub scratch or dig into the affected parts. If the itching of the alleged seven years' itch could be crowded into a few months' time, it would not be more aggravating.

ERUPTIONS.

Scarlatinaform rash, miliary papules, pustules and vesicles came in successive crops. They resulted from the more or less destructive inflammatory involvements of the follicles and their cellular elements, like thorns in the flesh or other foreign bodies. They were thrown off, leaving the skin honey-combed with small ulcers, oozing a hydro-serous discharge, alkaline in reaction. This discharge may be odorless or have a putrid smell according to the severity of the process. Some of the hairs could be drawn from their pockets as if they had been loosened by electrolysis.

EXFOLIATION OF THE SKIN.

Fifty, a hundred times, or more, the epidermis was thrown off in scales of various size, shape and consistency. In places slightly affected, the desquamation was scarlatinaform, the disease painless. Where quite severe, the scales were at first thick and macerated, pseudo-membranous. Late in the disease the scales became desiccated and appeared as they do, in many forms of skin disease. If the scales were torn away, the surface bled freely from the points of their attachment.

INFLAMMATORY MOUNDS.

Where the process is quite severe but attacks circumscribed areas more severely than intervening spaces, inflammatory mounds appear capped with a white membranous patch. In time the patch breaks down leaving a ragged-edged crater-like opening. A common position for these mounds is over the articular surfaces, but they may form upon the dorsum of the hand, the fingers and in other localities.

EXTENSIVE ULCERATIONS.

If the inflammatory process is severe, the eruptions, small ulcers and mounds all become confluent, the surface breaks down, forming large ulcerated excavations with a raised border. Their central position may be either naked or covered with a thick, whitish pseudo-membrane. Under these conditions the suffering is intense, the discharge sanious and offensive.

PAIN AND SUFFERING.

For a description of the pain and suffering, hyperaesthesia paresthesia, no language sacred or profane is adequate. The sting of the honey-bees or the passage of a renal calculus is painful enough, but are comparative pleasures, because being paroxysmal they have a time limitation.

Extreme tenderness to the slightest touch. Hot and cold waves and flashes, warmth, tingling, pricking, throbbing, stinging, crawling, boring and burning sensations, as if the parts were on fire and contained bugs, and other living things. Feelings as if the anatomical structures were being moved from one position to another. All of these sensations are proportionate to the depth of the inflammatory process. All forms of radiant energy, light, heat, magnetism, ultra-violet rays, etc., increase the suffering. The parts are irritated by soap solutions or attempts to use them for any purpose. The suffering is also augmented if the affected members are allowed to become dependent, hence the afflicted operator holds his hands high above his head, even sleeping with them in that posture. If the inflammation in his hands is severe, muscular action will be temporarily lost, the fingers immobile. He must be dressed, undressed and fed by attendants.

HEALING OF THE PARTS.

There are abortive efforts of the parts to heal. They heal over only to break down again, or healing in some places they break down in others. No healthy scabs form over the ulcers, no laudable pus, so called, appears. The formation of granulations and scar flesh is defective, consequently the processes of repair are indolent, ineffectual, requiring months to restore the parts. Eventually the epithelial cells will spread from the margin and islets, over the ulcerations, and the injured parts are thus supplied with a thin investment. Muscular power returns. Wherever the hair is restored, as it frequently is, it will return more vigorous.

Physiological rest, an elevated position, exclusion from all forms of actinic rays, the burning away of deciduous material with dioxygen, the employment of formaldehyde, ten per cent solution as an antiseptic wash, and a thick dressing of equal parts of vaseline and powdered starch, evacuation of pustules and the wearing of kid gloves for several months after the acuteness of the attack has passed, will afford considerable relief to the sufferer. Dr. Robinson of Philadelphia uses picric acid, Dr. Jering of the same city employes the lead plaster.

I quote the following, illustrating an extreme degree of chronicity of X-ray inflammation, also showing how the operators who work with the most powerful apparatus and the greatest number of hours per day, are usually the greatest sufferers.

London, Aug. 6, 1903, via Associated Press: "Two doctors belonging to the London Hospital have been affected by X-rays in a manner similar to that of the assistant of Thomas A. Edison, and have been compelled to abandon their work. They were engaged for a long time in making examinations of and manipulating diseased parts, while the X-rays were directed on their patients. When they began to suffer, they tried gloves on the backs of which lead foil was sewn, but these impeded the movements of their hands and were discarded. One of the operators ceased opertaing under the rays, eighteen months ago, yet his hands have improved little despite constant treatment."

To return to my own case, large red blotches and some pustules appeared upon my face and neck, with a burning sensation followed in time by desquamation and restitution. The parts were left sensitive to light, heat, etc. They, for a time, caused them to redden and peel in furfuraceous scales. My left hand was much involved; hundreds of minute abscesses formed upon the dorsum and the integument exfoliated many times. The nail of the ring finger came off but was renewed. The nails of all the digits except the thumb, became deformed, brittle and deficient in their usual luster. The shape of the hand was permanently changed, the ruga of the skin, the ridges on the nails, the knuckles and palmar arch are more prominent than they were formerly. Yawning caused muscular spasm of the fingers. Inflammatory mounds with their white caps and crater-like openings, came and went in the usual dilatory manner. Five months after the onset of the attack, the parts had healed but were so sensitive to the Roentgen rays that a fifteen minutes' exposure about one yard from the tube in a strong, high tension field, caused a secondary dermatitis. The period of inoculation, usually from one to two weeks, was reduced to as many days. The secondary dermatitis cleared up several large ugly patches of skin disease left them from the primary attack. 'Tis true that the X-light may, in a measure, prove to be a remedy for its own indolent process and sequelae. Eight months after the onset of the primary attack, improvement slowly but surely continued in the newly formed skin, the atrophic changes remained the same, but the hypertrophic changes had diminished. The skin was tolerant of all forms of actinic rays. The vaseline and starch dressing was still employed at night, but the wearing of gloves during the daytime was no longer necessary. In the primary attack, the right hand was less severely affected than in the left. Tenderness extended up both arms into the axillae. I suffered with malaise daily chill and fever (mild) headache, sore throat (mild), nausea and vomiting (severe but short), probably from cardiac impairment of function. There was a fine rash like that of typhoid fever, scattered over the entire body. Whether an attack of erysipelas sustained in both hands, about twelve years previous, predisposed me to X-ray inflammation, modified its course or prevented cancerous sequelae, I am unable to determine. Certain it is the two diseases (X-ray dermatitis and erysipelas) have many symptoms in common.

THE SEQUELAE OF X-RAY INFLAMMATION.

(1) More or less loss of integument with its appendages, hair, hair-follicles (alopecia), nails, sebaceous and sudirific glands.

(2) Disfigurement of parts involved, such as hands, face and head, by scars, pits, warts, pigmentation, baldness, a shave that requires no repetition, skin diseases, etc.

Small cicatrices form at the labial commissures, drawing the angles of the mouth downward, giving the operator a sad expression of countenance. Dr. Wagner of Chicago suffers with disfigurement of the face. A French operator is reported to have nearly lost his nose. Clarence Daily (case to be reported later) has scars upon his face and loss of hair. One entire hand and four fingers of the other have been removed. Dr. Early of Dayton, Ohio, has lost one finger. Dr. Kassabian has many small scars upon his face. Pigmentation has rendered his face much darker than its normal condition. A light streak separates the pigmented portion of his features from the hair of his head, giving him somewhat the look of a person wearing a mask. A picture of his hands is shown elsewhere. Girdwood, Grubbe, Kassabian, Skinner, Price, Waite, Platt, Detwiller and about one-third of the prominent operators and instrument dealers, well known by the writer, have hands which have been more or less severely injured. Blacker (case to be mentioned later) has gone on "the long journey to that bourne from which no traveler ere returned."

(3) Chronic scaly skin diseases and other conditions of the parts result because some of those little functionaries, the sweat and oil glands, that have moistened and lubricated your skin from the days of your inception are gone forever.

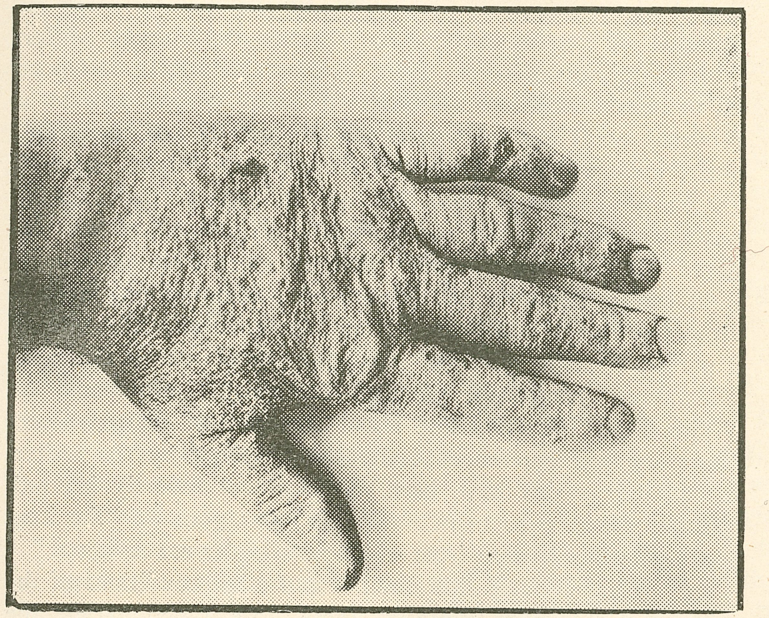
(4) Horny papillary thickening of the ends of the fingers, beneath and around deformed nails, crowding the nails away from their matrices. Horny ridges, lumps, nodules, warts or callous in other localities. Some of these formations mark the site formerly occupied by inflammatory mounds. Most of these formations can be softened and stripped off, but they

usually form again in the same places. Their subsequent degeneration into cancer will be considered later.

(5) Purpura hemorrhagia and punctate clots in the newly formed skin. The bleeding probably comes from the nutrient arteries of the defunct follicles.

(6) Erythema, either circumscribed in small irregular spots, in the skin and beneath the nails or diffused over the entire surface.

(7) Hyperaemia or anaemia, usually the former, the latter being confined to circumscribed areas.



Case I. Dermatitis, second month, showing exfoliation of epidermis; inflammatory mounds; one white cap over the carpus; other mounds with crater like openings on index and little fingers, also one on dorsum of hand. The rugae of the skin are very pronounced.

(8) Pigmentation or blanching of the tissues, either temporary or permanent. The surface may be left with a pigmented border and white center as shown in an accompanying picture.

(9) Hyperaesthesia to all forms of radiant energy and traumatism. This condition slowly decreases.

(10) Increased vaso-motor activity.

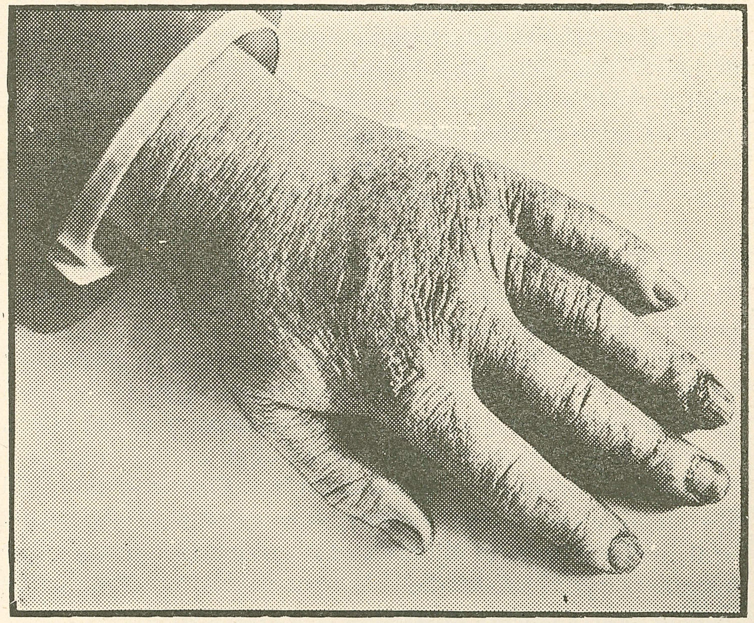
(11) Diminution or loss of the sense of touch in circumscribed areas. This sequel is rare.

(12) Small abscesses at the roots of the teeth (rare). See report of such a case, Philadelphia meeting.

(13) Temporary decrease of sexual power.

(14) Erratic or redundant growth of hair. See report of Dr. Girdwood and others.

(15) A tendency to spasmodic muscular contraction, and oedema.



Case II. Dermatitis, fourth month, the nail on the ring finger growing outwards as it is thrown off from its matrix. The skin has thickened about the other nails. A horny nodule can be seen on the index finger; desquamation still continues; the hair has been thrown off. Many papules can be seen on close inspection.

SECONDARY, TERTIARY, QUARTANARY DERMATITIS.

From careful observations, made upon patients and myself, I conclude that each attack of X-ray inflammation leaves the parts more predisposed to subsequent attacks, consequently, after several repetitions, from a given volume, strength, tension, and duration of exposure, the period of incubation decreases, while the inflammation developed will be more and more intense. One hand of the operator may develop dermatitis in a few days, while the other hand, which has been less frequently, or less severely, attacked, requires a week or more for its appearance, the former will be severely, the latter slightly, affected.

Even the different fingers of the same hand may have a different period of incubation and degree of action, according to their relative susceptibility. After repeated attacks, the period of incubation may be entirely wiped out, the reaction with a sensation of warmth or stinging and an inflammation more or less profound taking place immediately. Conversely a period of rest from raying, limitedly, decreases susceptibility.

WHY THE HANDS ARE SO FREQUENTLY INJURED AND WHY UPON THE DORSUM.

(1) They are not protected by clothing.

(2) They are usually a little nearer the tube than other portions of the body, dorsum outwards.

(3) It is a common practice, with operators, to employ the hand in front of the fluoroscope, dorsum presented to the tube, as an X-radiometer, judging by the translucency of the bones, etc., the degree of penetration of the X-light.

When the operator is right-handed he will instinctively hold the fluoroscope in that member, consequently the left hand will, in the course of time, be more seriously injured. The reverse is true if left-handed. When ambidextrous, both hands will be nearly equally affected.

OTHER DANGERS OF THE X-RAY OPERATOR—IMPAIRMENT OF VISION.

At the Chicago meeting of this society Dr. Scott of Kansas City reported that he had been so afflicted, attributing the same to the Roentgen rays.

Personally, I am unable without glasses to read medium print, which I could do seven years ago, before I became an X-ray operator. I consider the X-ray more or less responsible, but the fluoroscopic and dark-room work, not to omit the hand of time, have each contributed their quota to the impairment.

Mr. Thomas A. Edison reports that the focusing power of one of his eyes has been lessened by the Roentgen rays.

One of my X-ray colleagues has a mild form of ophthalmia, he believes to have been caused by the rays. Withdrawal from their influence is always followed by improvement. Drs. Kassabian and Waite have been similarly affected.

Ophthalmoscopic examination of my eyes, made during an X-ray inflammatory attack, revealed a deficiency of pigment in the choroid. The pupils of my eyes were small, and there wer indications of presbyopia, such as inability to focus perfectly the chrystalline lens for near and remote objects. Vision at thirty or forty feet was a little blurred and indistinct. This defect was overcome by distance glasses, but since my recovery such glasses are no longer required. I saw minute, bright, falling bodies upon the window pane, showing irritation of the retina.

THE EFFECTS OF THE ROENTGEN RAYS UPON THE GENERATIVE ORGANS.

When the X-ray operator has a mild but general attack of dermatitis the reproductive organs will darken. The hair over the symphysis pubis may or may not be thrown off. There will be desquamation of the scrotum and glands penis, although an investing fore-skin of the penis may not be affected. The sexual power will be temporarily lost. See report of experiments made upon the spermatoza of rabbits, American Roentgen Ray Society, Philadelphia. The urine contains no albumin.

COLLAPSING OF CROOK'S TUBE AND CUTTING OF FLESH BY THE CENTRIFUGAL FLYING FRAGMENTS OF GLASS.

This accident occurred to Dr. King of Bradford and was reported in The American X-Ray Journal, July issue of current year. The entire subject, including the danger to the eyes of the operator, has been considered by my predecessor, Dr. Pancoast.

POSSIBLE BUT NOT PROBABLE RESULTS OF OFT-REPEATED AND LONG-CONTINUED EXPOSURES TO THE ROENTGEN RAYS.

At the Chicago meeting of this society Dr. Grubbe reported that two patients whom he treated became deranged.

One of my patients developed a violent form of insanity with delusions and hallucinations; another was troubled with amnesic aphasia.

Both patients had been subjected to a long course of treatment for severe forms of carcinoma, and were of the nervous temperament.

Both cases terminated fatally.

Can the X-rays, like the solar rays, cause structural changes in the cerebrum, leading to derangement of the mental faculties, or do the ptomains from cancerous disintegration sometimes cause so profound an autoinfection as to bring about such psychical disturbances? Should you answer my primary question affirmatively, then it follows as a corollary, that the danger to the patient is in a measure shared by the operator, and solaroidal effects can be anticipated.

INFECTION.

The abraded tissues of the X-ray operator afford a fruitful culture field for infection with chronic malignant diseases with which his patients suffer.

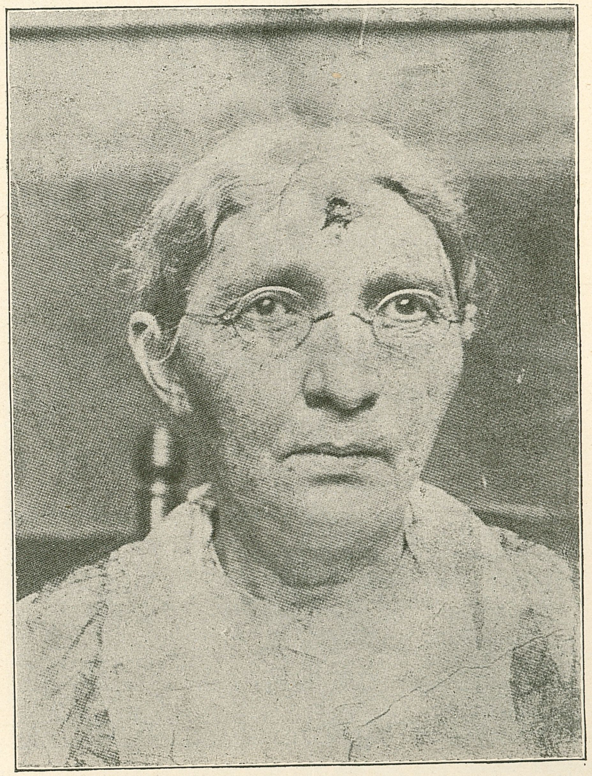
His office is thronged with patients suffering with some of the vilest forms of disease that flesh is heir to.

CANCER.

In the Associated Press report of August 3, 1903, appeared the following: "One of Thomas A. Edison's X-ray operators, named Clarence Daly, who had used the X-rays for several years, is to-day a physical wreck. Cancer broke out on both arms, one of which was amputated, and four fingers of the other hand had to be removed. His face is wrinkled and his hair fallen out."

In a personal letter received from Mr. Edison he assures me that this report is true.

I quote the following apropos, from The Electro-Therapeutic and X-Ray Era, September number, 1903: "The premature demise of an English physician from malignant disease is alleged to be traceable to an X-ray accident. Blacker suffered a severe burn on one of his fingers while manipulating the apparatus. This irritation produced an unyielding dermatitis, which rapidly ascended the arm. Cancerous disease of the skin now appeared at the elbow, and evidences of malignancy were soon perceptible in the axilla, the disease finally involved the entire shoulder, the progressive character of which precluded operation."

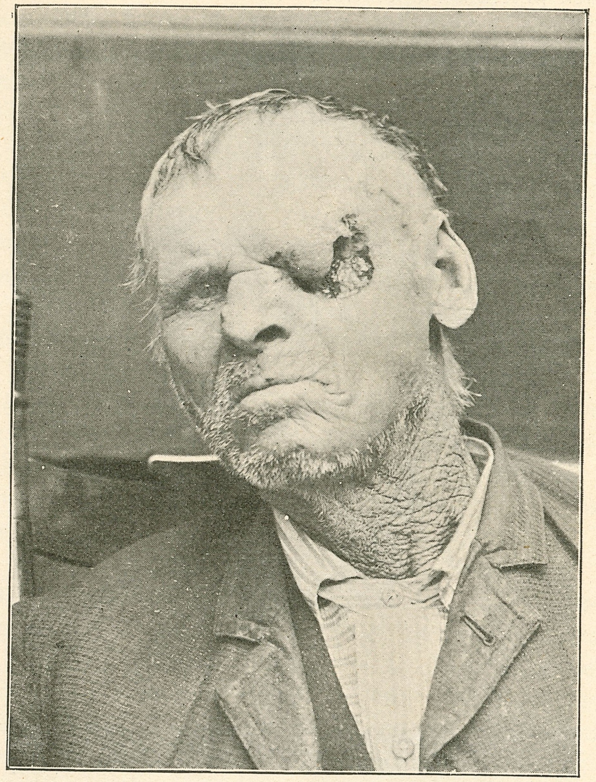


Case III. A patient with cancer on the forehead who says it was caused by the sting of a mosquito. Under treatment the parts healed, but through neglect on patient's part, they broke down again. Present condition unknown.

For other cases illustrating this danger I refer you to the current literature, dealing with the subject, rather than weary you with further quotations.

In order to throw the searchlight of investigation upon one of the etiological factors of cancer I will inquire of a patient who has that disease upon the forehead (see picture) what was the cause? She replies the sting of a mosquito.

I ask another suffering with epithelioma of the lips and cheek the same question. He says a cut from a barber's razor

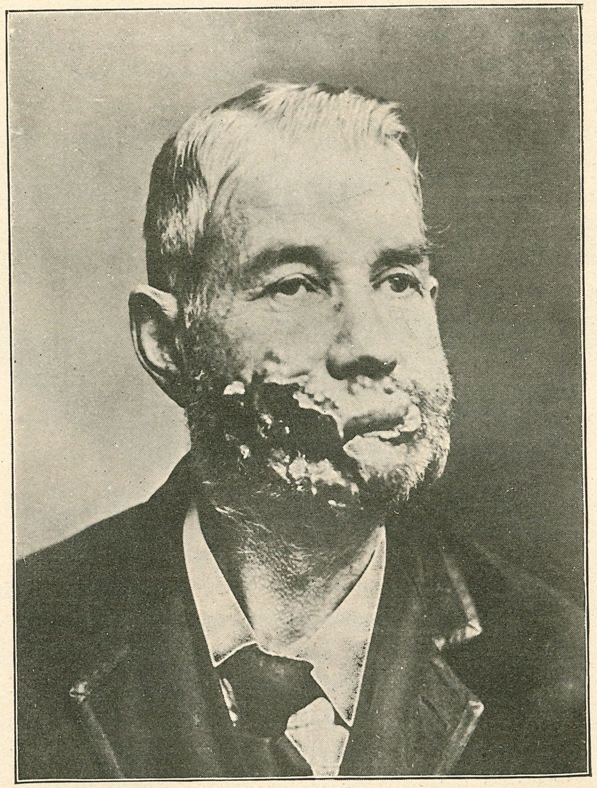


Case IV. Patient with osteo-carcinoma of the bones of the face, says it was caused by being struck with a stone. Under treatment the diseased bones came out en masse. One side of his face has had the shave that requires no repetition. His present condition is unknown.

Still another, with osteo-carcinoma of the bones of the face (see picture). Says he was struck with a stone.

A patient with one-half of his face involved fell upon a plank that cut his lip. Cancer subsequently developed in the cicatrix (see picture).

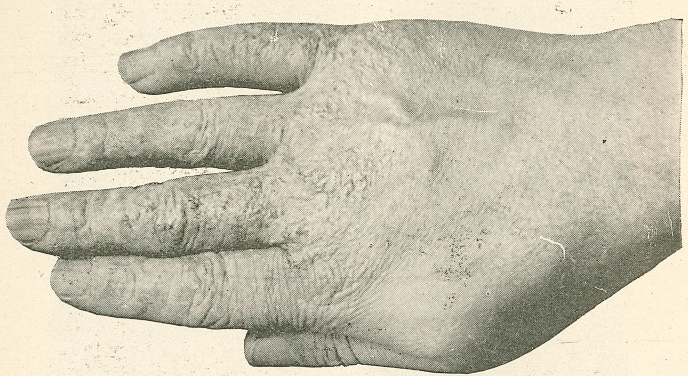
A lady with scirrhus of the breast and a matastatic focus on the face believes the primary lesion to have been caused by falling against a bedstead.



Case V. Patient with one-half of his face involved with cancer, said that he fell upon a plank that cut his lip, and cancer subsequently developed in the cicatrix. Under treatment there was a desperate effort made by the tissues to heal, but his strength failed and he died November 30, 1903.

In other words, slight injuries to epithelial tissues, in accord with the teachings of Conheim, the German savant, often prove a potent cause of cancer.

Is it strange, therefore, that X-ray inflammation, with its specific action upon this variety of tissue, be it physiological or pathological, should very rarely cause a cancer in an operator having the cancerous disthesis by degeneration of the horny ridges, nodules, warts, cicatrices, etc., left as sequelae or a retrograde epithelial metamorphosis superinduced by the inflammatory process?



Case NI. Post dermatitis condition of hand of Dr. Mihran K. Kassabian, X-Ray expert, Chestnut St., Philadelphia, Penn.

Patients subjected to a course of X-ray treatment of over one year's duration, who are not thoroughly shielded from the action where not required, may become emaciated, the parts exposed have eruptions, oedematous swelling and spasmodic contraction (slight), painful or otherwise. This danger is limitedly shared by the operator.

(9) Remain behind the target, the static machine or thick plate glass screens, having metallic bases, through the glass of which I can observe all that is transpiring, or examine my patient who holds the fluoroscopic screen, while I remain excluded from the X-ray field.

(10) If obliged to enter the field for any purpose, remain as far away from the excited tube, and work in the outer confines as much as possible. Do what is required then return to a position of safety immediately.

Another good plan for self-protection is to screen yourself from such pencils of X-light as would come your way with a copper plate placed so that you can see the working of the other portions of the tube, or screen the entire tube and observe its reflection in a looking-glass. A combination screen and tube holder, to invest the tube on all sides, with a suitable aperture for the egress of the rays, can be made of very thick glass.

The new form of clinical adjustable tables, with a copper or sheet-iron covering nailed onto the wooden top, the top turned on end, make admirable impromptu screens for many purposes.

The foreign makes of tubes, said to be made of glass, which is opaque to the rays except at a limited area, are worthy of trial.

Such precautions I now scrupulously maintain, for my recent experience with this subtle force, reminds me of the words of Shakespeare, given to the ghost of the erstwhile Hamlet, King of Denmark (paraphrased):

"My hour has almost come,
When I, to sulphurous and tormenting flames
Must render up myself.
Doomed, for a certain term, to walk the night;
And for the day, confined to fast in fires,
Till the foul ****** (unnatural condition) of
My body, is burned and purged away."

Buffalo, N. Y.

DISCUSSION.

Dr. Weston A. Price, Cleveland, Ohio, showed a flexible rubber cloth that is entirely opaque to the rays, heavy, will not break or bend. It can be made into aprons or jackets and vests or gloves. It offers perfect protection both to the patient and to the operator. He believes that with time there is an increasing tendency to be affected by the ray. Possibly there is a cumulative action that later in life may lead to very serious difficulty, or even tend to have a fatal ending. He also exhibited a tube holder made of vulcanized opaque rubber. It is a non-conductor and there is no tendency to spark across.

Dr. James A. Marsh, Troy, N. Y., called attention to the fact that he was suffering severely from an affection of the feet due to X-radiance to which he exposed himself unconsciously while his tube was excited.

Prof. Goodspeed expressed his opinion that this effect probably was due to the fact that the whole room and its contents are rendered negatively active during the action of the tube.

Dr. Chas. L. Leonard, Philadelphia, suffered from burns of the hands and feet, but protects himself now by enclosing his tube in a paper box wrapped around with lead foil so as to exclude the rays from his body. It also affords protection to the patient. It is of equal importance to know something that will cure these burns. Personally he has found soaps containing resorcin very effective; also inunctions with lanolin and boric acid.

Dr. Kassabian keeps his coil up near the ceiling of the room and puts the tube into the box of his apparatus that he exhibited in connection with his paper in chest skiagraphy. By means of a reflector attached to his tube by a rod he is enabled to see the color of the rays without exposing himself to the ray.

Dr. Louis A. Duhring, Philadelphia, compared the X-ray burn with eczema in the variety and multiplicity of its clinical manifestations, although pathologically the two processes are entirely dissimilar. Therapeutically the X-ray burn is as capricious as it is in its pathologic manifestations. No one single remedy will cure all cases. Every operator appears to have some remedy that has helped him, but that same remedy fails to do anyone else any good. He could not suggest anything that will cure all cases, but advised that operators try various remedies until they find the one that will do them the most good.

Dr. Egelhoff obtained relief by washing his hands in water as hot as he could stand it, before retiring, using plenty of green soap and a hand brush; this he followed by liberal inunctions of olive oil, and then covered his hands with a pair of kid gloves.

Dr. Fairfax Irwin, U. S. P. H. and M. H. S., had two cases of intractable ulcers due to the X-ray that he finally cured by shutting off the light. He enclosed the affected areas in a wooden box, and much to his surprise the ulcers healed up very promptly, after having existed for five months.

METHODS OF ROENTGEN RAY TREATMENTS OF MALIGNANT DISEASES OF THE UTERUS, RECTUM AND BLADDER.

(Abstracts from a paper by Margaret A. Cleaves, M. D., in the "Medical Electrology and Radiology.")

The author first notes that even should the rays penetrate the body, their action on deeper tissues must be very much less than on superficial tissues. It is also noted that toxic products of diseased tissues are often released during the treatment and a toxemia results. It is also pointed out that the reports of cases have shown the complete disappearance of a surface carcinoma after a course of treatments, but the growths returned much more rapidly in the neighboring tissues after several weeks of rest. Thus, Hyde, Montgomery and Ormsby in such cases have proved that the doubtful tissue is typical carcinoma, and it is their belief that metastases have occurred during the successful treatment of the primary growth.

The writer holds that much less danger would be incurred by treating the pelvic organs in the female through the rectum and vagina.

The author uses a Caldwell tube for rectal and vaginal work, and a special tube with a very small projection for insertion through the urethra in desical cases. Three cases are mentioned, described in detail elsewhere, in which the method was of great success. One case was inoperable, a recto-vaginal perforation having taken place and the rectum and uterus badly involved. The case yielded promptly to X-ray treatment, the recto-septum being restored.

Editorial.

With the present issue we begin a new volume, and because of the great interest taken by physicians in other forms of radiant energy besides the X-ray, we have changed the name of the journal from "*American Electro Therapeutic and X Ray Era*" to the "*Archives of Electrology and Radiology*." There will be an increase in our editorial staff, as our future issues will show.

The word electrology is used to denote the science and application of all forms of electricity to therapeutic uses. The word radiology denotes all forms of radiant energy, such as ultra violet light, the X-ray, sunlight and the radiations from the elements uranium, thorium and radium.

This name has been suggested by Dr. Clarence E. Skinner of New Haven, Conn., who is vitally interested in the welfare of the journal.

As in the past, we are not advocating the use of any special agent, but we aim to give the results of actual experience by competent men.

In the present issue we conclude Dr. Pitkin's paper read before the American Roentgen Ray Society, the first part of the article being in our December issue. We also give a very full report of the other papers which we do not expect to publish in full. We shall not give these in the order in which they occurred on the program, because the order is of little importance except to those who were actually at the meeting.

The next meeting of the Chicago Electro-Medical Society will take place on Tuesday evening, February 23, at 8:15 p. m., in room 412 Atlas building. A paper will be given by Dr. May Cushman Rice on the "Glass Electrodes as an Adjunct to the X-Ray." A further discussion on the operation of the static machine will be led by Dr. Burdick.

MINUTES OF THE CHICAGO ELECTRO-MEDICAL SOCIETY.

The December meeting of the society was held in room 412 Atlas building December 22 at 8:30 p. m. Dr. Burdick as president was in the chair. The committee on membership gave a report of progress and a general discussion on methods of arousing interest in electro-therapeutics and the X-ray ensued. The following were proposed for membership: E. T. Rellahan and N. O. Nelson. The election of officers was deferred for 3 months. A paper was then read by Mr. C. H. Treadwell on "Explanation of the Generation of Charges in the Static Machine." The paper was discussed by Drs. Grubbe and Burdick, Mr. Nelson and Mr. McIntosh. It was agreed that the discussion of the paper be continued at the next meeting.

❧

PHYSICAL PRINCIPALS INVOLVED IN THE OPERATION OF THE STATIC MACHINE.*

BY C. H. TREADWELL, B. S.

Mr. President and Members of the Society:

I shall attempt to set forth the principles on which the static machine operates, confining the discussion entirely to the Holtz and the Toepler-Holtz machines, the Wimshurst machine operating on a slightly different principle. It must also be stated that this exposition is not at all original, for I shall endeavor simply to give what I understand are the views of physicists on this subject.

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*Read before the Chicago Electro Medical Society, Dec. 22, 1903.

The static machine should be called an induction machine, and it is therefore necessary to explain the production of inductive charges under conditions as simple as possible. I will therefore perform a few introductory experiments with these insulated electrodes of the static machine, using these because of the simplicity of the operation and because any physician can repeat the experiment.

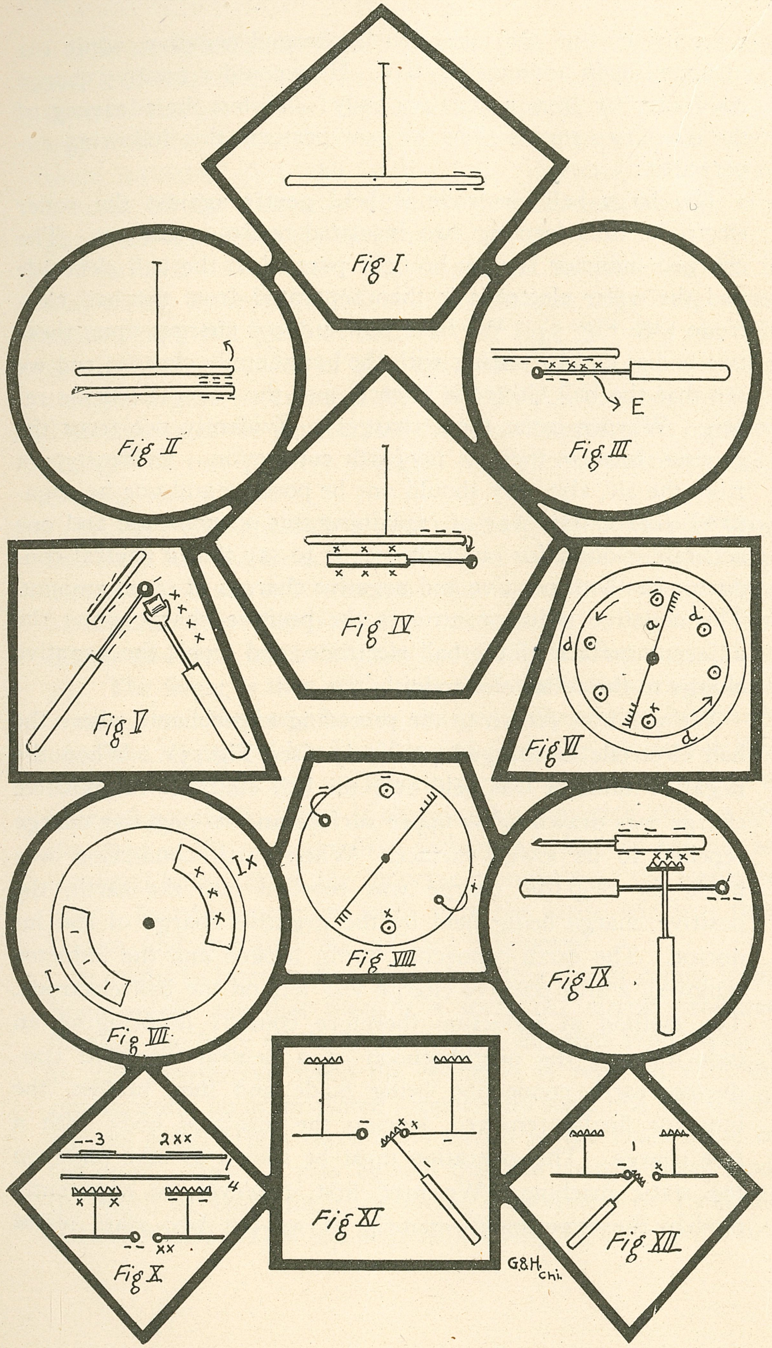
This hard rubber rod I will suspend at its center so that it may swing horizontally. It will be charged negatively when rubbed with this piece of flannel (see Fig. 1). We see that the insulating handle of this electrode (see Fig. 2) is also charged negatively and that there is repulsion between the two. This illustrates the general law that like charges (two negative charges or two positive charges) will repel, whereas unlike charges will attract.

We will now generate a positive charge by induction upon this large ball spark electrode, which serves as an insulated conductor. You see it is necessary for me to hold the charged hard rubber rod—that is, the inductor—above the insulated conductor and then touch this last body with the finger (see Fig. 3). The finger is then withdrawn and the inductor afterward removed and the body is now charged. By testing its charge upon the suspended hard rubber rod (see Fig. 4) we see that there is attraction, and we therefore conclude that this body is charged positively. This is charging by induction and we see the steps of the process; first, a charger inductor; second, an insulated body; third, the inductor brought near the insulated body; fourth, connection made with the earth, which is then broken, and afterward the inductor is removed.

It might be interesting to ask where this charge comes from. Some might say that there is a sort of circuit produced through the body of the experimenter, but that supposition is at once overthrown when the operation is repeated with the experimenter on an insulated support and some one else touching the body. Here there is no circuit in the usual sense of the word. Again it may be said that the charge comes from the earth or from the surrounding atmosphere or from the inductor itself. This last supposition may be dismissed when we consider that the induction is charged negative, while the insulated body becomes positive. How could a positive charge come directly from a negative body? To test the adequacy of the other two suppositions we now perform this following experiment:

The large ball electrode is held gently against the roller electrode, thus forming two insulated bodies in contact. The charged inductor is now brought parallel to the ball electrode and the roller electrode is then separated from the ball electrode (see Fig. 5). We have now induced charges upon these two bodies and by testing with the horizontally charged rod we see that the ball electrode attracts and the roller electrode repels. Whence came these charges? Evidently not from the ground, because there is no earth connection. Evidently not from the air, else why should one be positive and one be negative? The easiest way of explaining this phenomenon and one accurate enough for our purposes is to say that a neutral conductor has both positive and negative charges of equal amount. The negative inductor attracts the positive charge upon the adjacent surface of the ball electrode, and repels the negative charge to the roller electrode.

We will now return to the preceding experiments where the ball electrode is charged positively (see Fig. 3). When the negative inductor was held over the ball electrode the positive charge was drawn to its upper surface and its negative charge repelled to its lower surface. When earth connection was made the negative charge was repelled into the earth, the positive charge being held by the negative charge of the inductor. The earth connection being broken and the inductor removed, a free positive charge was left on the ball electrode. The method of induction therefore consists in bringing an inductor into the neighborhood of a neutral insulated conductor, earth connection being made and then broken, the inductor finally removed, leaving the insulated body with a free charge. This operation must be shown to take place on the static machine. We need first, however, to apparently modify the experiment—namely, if we put two glass plates



between the inductor and insulated conductor, the operation of induction will still produce charges.

We shall consider this little model because there is no case around it and we can touch all its parts. It is identical in principle with the large Toepler-Holtz machine (see Fig. 6). The smaller circle represents a rotating plate on which are glued the metal disks. The larger circle is a stationary plate on which are the paper sections shown in Fig. 7.

Corresponding to the finger is this brass rod called the neutralizing rod (see Fig. 6a). These metal disks on the rotating plate are the insulated conductors, while the inductors are the paper sectors on the stationary plate (see Fig. 7, I). These are sometimes called condensors or armatures, or the field, but I have much doubt of the suitableness of the term. They can scientifically be called inductors. One of these inductors becomes charged positive and the other negative by friction between the tinsel brushes on the arms fixed to the inductors, or, if you please, by the contact charge due to the touching of these different metals in the tinsel brush and the disks on the rotating plate. However, if only a very feeble charge is given to one of the inductors, the machine will generate. Referring to the experiment on induction, we see that the important time in the process is when the finger touches the insulated conductor, and so it is when the metal disks on the rotating plate pass beneath the tinsel brush on the neutralizing rod that charges are generated. Let this left inductor be positive and the disk be in position indicated by the figure. (See Fig. 6.)

Note.—The plus signs on figure IV should be on the metal part, not on the insulated handle. In figure V the ball electrode should be positive and the roller electrode negative.

Evidently a positive charge will be repelled through the tinsel brush into the neutralizing rod, and when the disk leaves the tinsel brush a negative charge remains on it, because a positive charge has been driven from it. This charge is imparted to this collecting tinsel brush connected wtih the right inductor (see Fig. 8), and every successive one thus brings a negative charge to this conductor, making it more and more negative and preventing its charge from deteriorating due to leakage.

A similar process is going on at the lower part of the neutralizing rod where the disk is touched by the finger in front of a negatively charged body, and therefore a negative charge is repelled up the neutralizing rod. Thus a free positive charge now remains on the disk, as shown in Fig. 8, and this charge is conveyed by the rotating plate to the collecting tinsel brush connected with the positive inductor. Every successive disk brings a charge to this inductor. And so the operation of the machine, so far as the disks are concerned, is to store up charges upon the inductors on the stationary plate. But you are more interested in how the charges are conveyed to the prime conductors. We must here bring in another principle of physics.

Imagine the hard rubber handle of a static machine electrode is charged negatively by friction (see Fig. 9). Let the multiple point electrode and the large ball electrode be held crosswise, as in Fig. 9, the points being near the charged body I, as indicated. If this inductor is charged negatively it will draw a positive charge upon the points and repel a negative charge to the ball, these two opposite charges residing previously upon the neutral conductor. This positive charge cannot remain upon these points, but will be discharged as a brush through the air.

Referring now to our drawing (Fig. 10), we see that the same thing holds true in the static machine, only that there are here two glass plates between the inductor and the points. The machine is viewed from above, the neutralizing rod and the brushes and arms connected with the paper sectors being omitted; 1 is the stationary plate on which are the paper sectors 2 and 3, which are charged positively and negatively respectively; 4 is the rotating glass plate. The prime conductors are also indicated. This does not, however, affect the inductive action of the inductors. These points, therefore, should not be called collecting combs, but rather discharging combs, and if this explanation be true, these points must be oppositely charged from balls of the prime conductors. This point will be duly proved after all parts of the machine have been described. We must state emphatically here that the charges upon the prime conductors are not brought to them by the revolving plates, but rather that the conductors become charged positively and negatively, because respectively negative and positive charges are drawn off from the horizontal row of points facing the revolving plates.

FUNCTION OF THE POINTS ON THE NEUTRALIZING ROD.

These points have a most important function, as shown in the diagram (Fig. 8). The upper end of the neutralizing rod is in front of the right inductor and the points on the lower part are in front of the left inductor. If the right inductor is positive it will draw from those points a negative charge upon the revolving plate, which will then pass to the left so as to be in front of the left inductor, and both of these being negative, they will draw very powerfully upon the positive of the left prime conductor, drawing a positive charge upon the horizontal points facing the rotating plates, which leaks off upon the rotating glass plates, leaving the ball of this prime conductor negatively charged (see Fig. 10). Just the reverse action takes place at the lower part of the neutralizing rod—namely, these points being in front of the negative inductor of the stationary plate, a positive charge is drawn from these points upon the glass plate, and this is carried by the rotation of the plate in front of the right horizontal combs of the prime conductor. This positive charge, together with the positive of the right inductor, draw continuously negative charge from the horizontal row of points, leaving the ball of the right prime conductor positive.

THE OPERATION OF THE HOLTZ MACHINE.

This machine has no buttons upon the rotating plate and is therefore not self-charging. A small Toepler-Holtz or Wimshurst is placed at one side of the case to give an initial charge to the inductors on the stationary plate. A very important difference between this and the Toepler-Holtz machine is that the inductors of the Holtz machine have a row of paper combs pasted horizontally across the inductors. From these combs a negative charge is drawn off upon the rotating plate if the right inductor is positive, while a positive charge is drawn off from the negative left inductor. Perhaps the two best known Holtz machines are the Waite & Bartlett and the Van Houten & Ten Broeck. The stationary plates of these machines are in two sections, so that there will be a good opportunity for the charges to be drawn from the paper inductors upon the rotating glass plate. At the same time charges are drawn upon the opposite side of the rotating glass plates from the points of the neutralizing rod just as in the Toepler-Holtz machine. Hence the very important difference between the Holtz and the Toepler-Holtz is that the former uses both sides of the revolving plate to carry charges, whereas the latter uses only that side nearest the horizontal points of the prime conductors. In other respects the operation of the two machines is identical.

Another class of machines is the combination Holtz and Toepler-Holtz. In these machines one or two of the revolving plates are provided with metal disks, whereas the rest are free from these, but the stationary plates facing these have their inductors provided with the row of paper or tinfoil points. These machines are self-charging and at the same time possess the inductive properties of the pure Holtz machine. Some of these machines do not have a window or hole in the stationary plate for the charges to be drawn off from the inductors upon the inner surface of the glass rotating plates. It would seem that the output of these machines would be increased by adopting the window or the slit in the stationary plates, such as is found in the Van Houten-Ten Broeck and Waite & Bartlett machine. The Engeln machine has the very interesting method of obtaining the inductive features of the pure Holtz without the division of the stationary plates. A tinfoil slit runs from the center of the inductor to the circumference of the stationary plate and a metal arm connected with these and provided with points is set at about right angles to the neutralizing rods.

In conclusion, then, this explanation seems to differ from the one usually given in that the horizontal row points connected with the prime conductors are here said to be charged oppositely to the charge upon the balls to which they are connected, and they are thus not collecting points, but discharging points.

PROOFS.

The proof of all this is that a point connected to a positively charged body is surrounded by a bluish brush in the dark, whereas a negatively charged point has a little star at its end. This can be very easily proved by any physician. First determine the positive prime conductor by pulling apart the discharging rods and observing the color of the spark discharge between the two balls. With the condensors off, the positive end of the brush will look redder and the negative end will look whiter. There are, of course, other ways of determining the charges of the prime conductors.

While these poles are widely separated place the multiple pointed electrode close to the positive ball, as shown in Fig. 10, and its points will then become positive and will show a bluish brush; place this electrode in contact with the negative pole and the points show a little star (see Fig. 12). Hence a positive point means brush and the negative point a star. Look now into the case and the horizontal teeth in metallic connection with the negative pole are positive—that is, they are brush, whereas those in contact with the positive pole are negative—that is, they show a star.

Again, if the right inductor is positive, the teeth of the neutralizing rod in front of this will be seen to be star—that is, negative; while the lower set of teeth or combs of this rod which are in front of the negative inductor are brush—that is, positive.

Another method of finding the kind of charges on the outside electrodes is to hold in the hand the single-pointed brush electrode near the prime conductors. The positive prime conductor will draw from the body of the experimenter a negative charge to the point of the electrode held in the hand, which will then show a star. A knife held in the hand will answer the same purpose, and this knife can be held in the hand and presented to different parts of the machine, thus showing the different kinds of charge which reside on the rotating glass plate or inductors of the stationary glass plate.

DISCUSSION.

Dr. Grubbe asked whether the horizontal so-called collecting combs could not be displaced by a cylinder, or instead of points put rounded balls. The answer was that they certainly would work if these were collecting combs, but although the experiment had not been tried by the speaker, that the theory certainly demanded that this would not work.

Dr. Grubbe then told of the machine of Otto Von Guerke, which consisted of a large cylinder of sulphur mounted on a shaft, which was provided with a handle so that the cylinder could be turned rapidly. The hand was held against the cylinder and the friction generated a charge on the sulphur. A large cylinder was placed near the cylinder and very heavy sparks could be obtained from this.

Mr. Nelson was then asked whether he had tried such an experiment with his static machine, and replied that if balls were used instead of points, the output of the machine would be very much reduced. He then went on to say that he believed the explanation given in the paper was correct, and said that the theory ought to explain why grounding the negative pole would very much increase the potential of the positive pole. He said he had noticed that one or two discharging points facing the glass plate acted just as well as a greater number and that the position of the neutralizing rod was very important; that when the rod was nearly horizontal it seemed to affect the charge of the tinfoil condensor of the inductor. He did not agree with the speaker that the lessened output of the machine when the neutralizing rod is nearly horizontal is due to the short-circuiting action of this rod between the two

sets of horizontal points on the prime conductors facing the rotating plates.

Dr. Burdick's discussion will appear in our next issue.

Mr. McIntosh said that owing to the lateness of the hour the discussion had better be continued at the next meeting of the society, as he wanted the matter more fully discussed. The society took the same view and further discussion was adjourned.

RADIO-ACTIVE GAS FROM THE BATH MINERAL WATERS.

H. S. Allen, in Nature, reports that he took samples from the King's Bath Spring in this research. The gas was expelled from about 1½ pints of the spring water by thoroughly boiling this at half atmospheric pressure. The gas was passed through a number of small drying tubes and was then collected. Only a small quantity of gas was thus obtained. It was then tested for its radio-active property, and was found to have these. The gas did not acquire its greatest activity until about one-half hour later, while in another half hour it diminished to one-half its maximum value. Rutherford had observed a similar effect from the radium emination and the author led to the query as to whether the mineral water did not contain radium emination. If this radio-active gas is of medicinal value it may account for the fact that the waters taken fresh from the springs seem to have a greater efficiency than after being shipped to other places.

AMERICAN ROENTGEN RAY SOCIETY.

The fourth annual meeting of the American Roentgen Ray Society was held in the auditorium of the Houston Club at the University of Pennsylvania, Philadelphia, December 9-10, 1903, under the presidency of Professor Arthur W. Goodspeed.

The meeting was well attended, the program was most excellent and the discussions were spirited and of much value. The reports of the secretary and the treasurer were very gratifying, inasmuch as they showed the society to be in a very flourishing condition. The membership numbers about 400.

The first paper on the program was read by Dr. Wm. S. Newcomet of Philadelphia, entitled:

"PATHOLOGIC CHANGES IN TISSUE UNDER THE INFLUENCE OF THE X-RAY."

The degenerative changes of the X-ray are not characteristic. Slight burns resemble sunburn, but severe burns are peculiar and may run through an incubation period of several months. If the ulceration does not go below the superficial structures no scar is formed, but a scar is inevitable if the deeper structures are involved. The important early changes in tissue destroyed by the ray are, first, fatty degeneration with vascularization of the epithelial pearls; second, a leucocytic infiltration of a varying degree. Bodies indistinguishable from Plimmer's bodies are found. The X-ray has a tendency to stimulate tissue growth. Rapidly growing deep or superficial growths early produce metastases. No single form of degeneration is characteristic of the X-ray. The form of degeneration depends on the method of application of the ray, and the particular tissue that is exposed. It would seem that the effect of the ray is on certain cell elements in exposed parts, but why certain normal cells, like the cells of the hair follicles, should be more susceptible to the ray is still a matter for speculation. The ray produces a great degree of vascular disturbance and this may play an active part in the changes that are peculiar in tissue exposed to the action of the ray. Slow-growing growths always do well, whereas the rapid-growing growths do not. They are irritated by the ray and stimulated to excessive growth.

DISCUSSION.

Dr. Gordon G. Burdick, Chicago, took exception to the last statement. He has never seen the ray stimulate a growth, because he does not use such a penetrating ray. The rays should not be sent beyond the point at which they are expected to exert their energy. By using a ray having a lower penetrating power osteosarcomata and spindle-celled sarcomata shrink very rapidly. Pathologically, it appears that the epithelial tissue suffers at the expense of the connective tissue, but whether this is because of a choking of the epithelial cell by the connective tissue cell or a primary death of the former is not known.

Dr. Jos. C. Clark, Olean, N. Y., finds that the short history cases are best left alone, because the ray always irritates them. He treats these with caustics.

Dr. Weston A. Price, Cleveland, Ohio, suggested the possibility that all tubes have in them a variety of rays, both the high and the low penetrating rays. Therefore it is impossible to select a tube having a certain ray only.

Dr. Henry Hulst, Grand Rapids, Mich., said it is useless to measure the penetrating power of any given tube. The first effect on the tissue of the X-ray is that of stimulation; the second is that of depression, and if this continues death of the tissue may follow. The difference in the effect of the ray depends largely on the quantity absorbed. The rays given off by a higher tube are not absorbed so much as those emanating from a low tube and do not produce as early secondary depressing effects. It is not good sense nor good practice to treat a skin lesion with a ray that will penetrate a brick wall.

Dr. Burdick, in explanation, said that he always reduces his therapeutic tubes below the line where any X-ray is given off at all and in that way he knows the exact penetration power of his tubes, and it is within his control by regulating the speed with which we drive the cathode stream. This in turn is controlled by the electro-motive force of the apparatus, which can be raised as desired by increasing the resistance in the circuit. For superficial work he uses one-eighth inch spark gap on either side of the coil; for epitheliomata, one-fourth inch is sufficient. The fluorescent ray is stimulating, but has no photographic power.

The next paper was read by Dr. Chas. L. Leonard of Philadelphia on:

"THE RESULTS OF THE ROENTGEN METHOD IN THE DIAGNOSIS OF RENAL CALCULUS."

The application of the X-ray in the diagnosis of stones in the kidney has been attended by marked success. The diagnosis of renal and ureteral calculi can be made with error of less than 3 per cent. In 89 cases a mistake was made in only 9 cases. Sixty per cent of the stones in these cases were found in the ureter. In only one out of the 89 cases did the X-ray show a calculus to be absent when it was found at the operation. If the negative shows a calculus and the operator fails to find it, it does not signify that the X-ray is in error, because in most of these cases subsequent operators have found the calculus. The X-ray is of great value as a means of differential diagnosis between various lesions of the kidney which closely simulate each other. Ureteral calculus may simulate appendicitis or oöphoritis. But the X-ray will not be employed as a routine agent in diagnosis until its use is demanded by the general practitioner. More than half of the calculi found in the kidney do not give rise to symptoms until they reach the pelvis of the ureter. The X-ray used in this connection facilitates operation by giving the size, number and location of the calculi. The surgical shock is lessened; there is less danger of operating on the wrong kidney, and no calculi will be left behind when the skiagraph shows that they are there. Exploratory operations become unnecessary. The operation becomes complete and comprehensive. The treatment of kidney lesions should not be undertaken until the kidney has been rayed.

DISCUSSION.

Dr. James B. Bullitt, Louisville, Ky., said that there are two classes of men who refuse to use this valuable method of diagnosis of kidney disease. One the surgeon who is too busy, as he thinks, to use it, and the other the man who has not been successful with the X-ray work and lays it to the ray or the apparatus. In the hands of good men very small stones of very slight density can be demonstrated. The value of the method is incontrovertible. He cited a case of a kidney so far gone that nephrectomy was done. The pelvis of the kidney was opened and several stones were found. For experimental purposes the kidney was rayed, when, much to his surprise, another stone was found high up in a calyx, one which would have been overlooked in a nephrotomy for renal calculus, and another operation would have been necessary later on, thus invalidating the first. Similar cases have been reported by Leonard and by Bevan and others. This method also gives us an opportunity to observe whether or not the stone will be advanced through the proper channel or whether operation is necessary.

Dr. Henry Hulst, Grand Rapids, Mich., cuts out the secondary rays which are apt to create confusing shadows on the plate by compressing the body of the subject. He accomplishes this by means of a compression diaphragm, between which the patient is squeezed. Another method is the inflation of the colon with air. This is especially applicable in the case of a large subject. He measures the penetration of his tubes by the Walter skiameter. For a large subject he uses a tube that will penetrate through six openings; for a small subject five. It is better to use a low tube with a longer exposure than a high tube with a short exposure.

Dr. Leonard stated that his technique is the simplest; that he uses neither diaphragms nor compression apparatus. The patient is placed on the back with the head and hips elevated so as to bring the lumbar region as close to the plate as possible. The tube having a resistance of from one and one-half to two inches parallel spark gap is placed at a distance of 18 inches from the body.

Dr. Clarence E. Skinner of New Haven, Conn., read a paper entitled:

"TWO CASES OF SEVERE X-RAY NECROSIS, PRESENTING SOME UNUSUAL FEATURES."

(See paper on page 433, December issue.)

Dr. Skinner also reported a case of cervical adenitis that had been treated successfully with the X-ray, but in which there appeared a new growth of hair on the side of the neck and face which had been exposed to the ray. The hair, which was quite long, appeared in regions that normally are entirely devoid of hirsute growth.

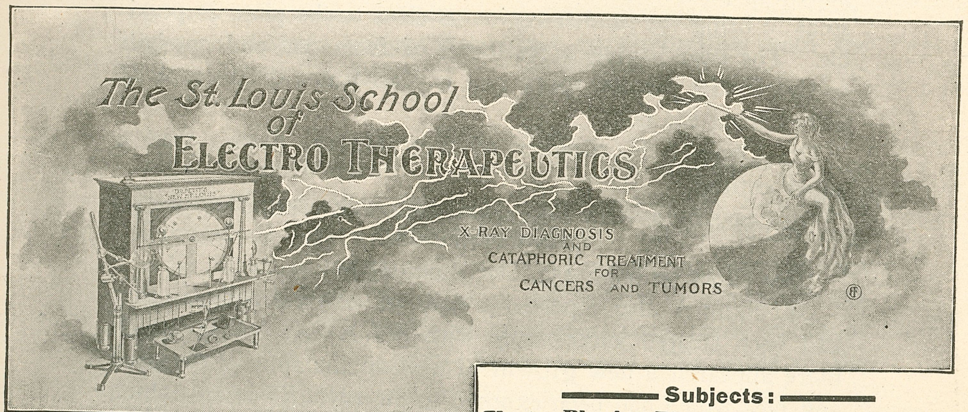
Dr. Newcomet reported the case of a lady of 80, treated for epithelioma of the forehead, who prior to the X-ray treatment had been quite bald. After some time there was a most profuse growth of hair over her forehead and partly backward from it.

Dr. Pancoast cited a similar instance in which a man developed a heavy beard after X-ray treatments, whereas he had but a very scanty growth before that. Personally his hair on the left side of the head fell out considerably for a time, but now it is heavier than ever.

Dr. G. P. Girdwood said that although quite bald formerly, since he had been using the X-ray his hair had again begun to grow.

Dr. James B. Bullitt, Louisville, Ky., reported a case of necrosis occurring several years after the primary injury had been sustained. A young man engaged in the manufacture of X-ray apparatus burnt the side of his face very severely. It finally healed up, but a year later he developed an abscess on the root of every tooth in his mouth, occasioning him considerable pain and inconvenience. Evidently the nerves had all been destroyed.

Prof. Goodspeed felt that many of these phenomena are due to a secondary action on the walls of the room. Everything in the field of an X-ray tube is secondarily active and sends off rays of some sort which have some of the characteristics of the X-ray, and it is to these rays that these indirect effects must be ascribed.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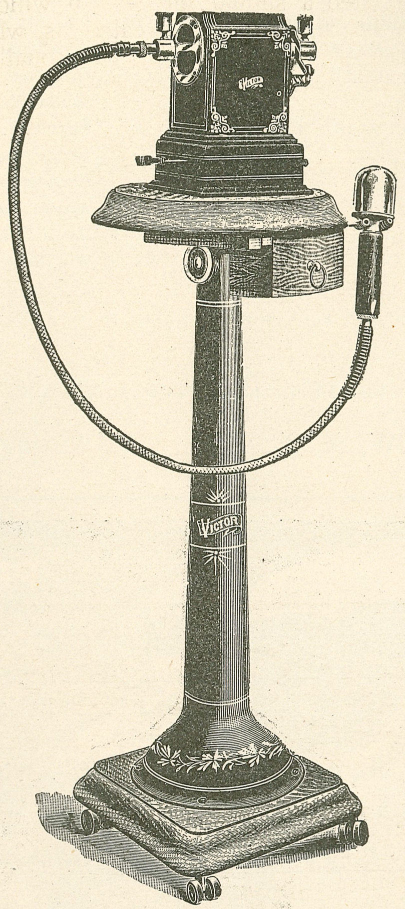

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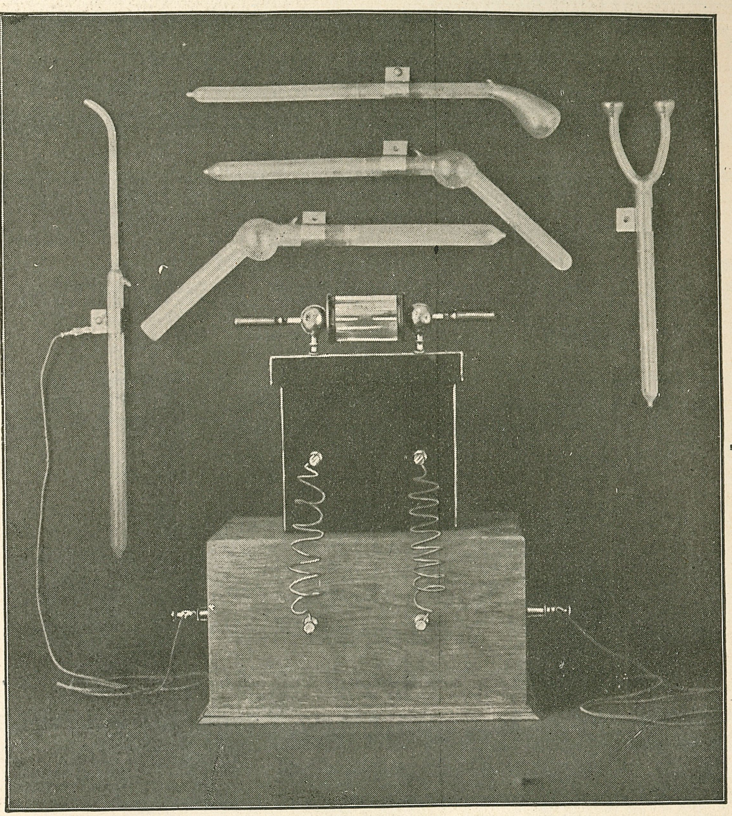

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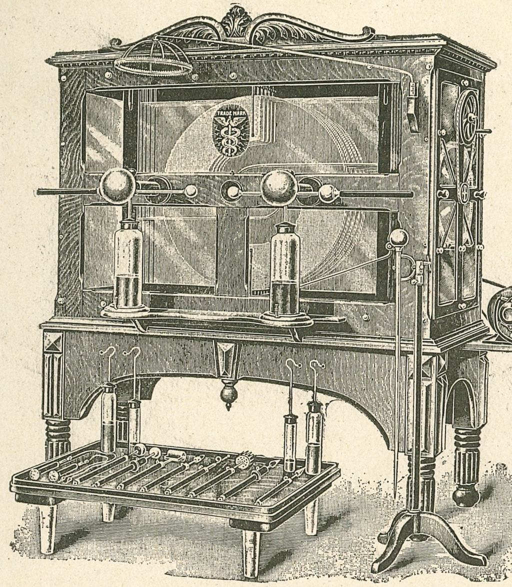

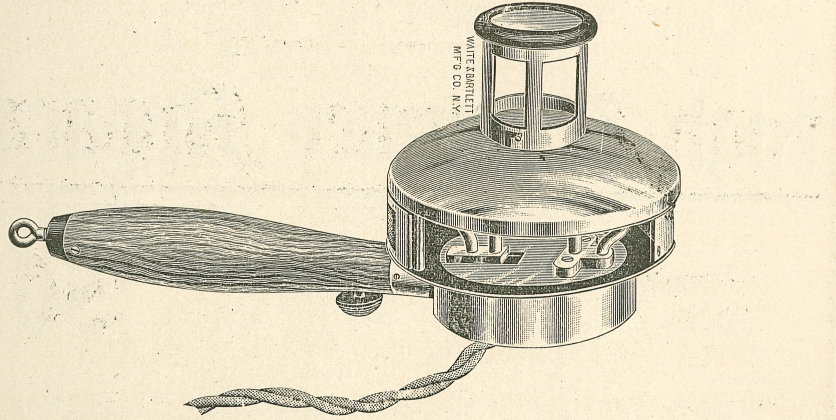

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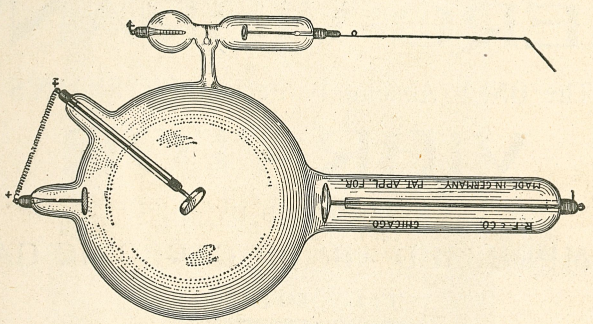

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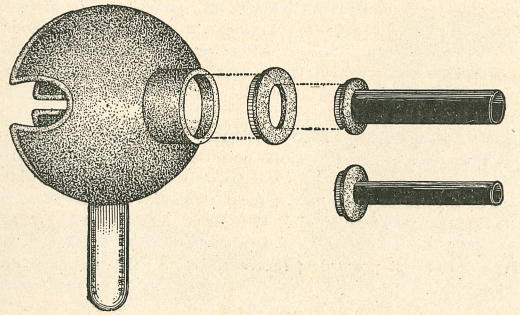

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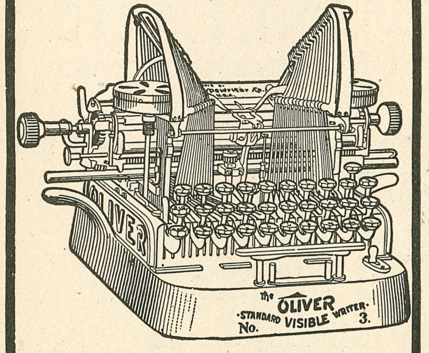
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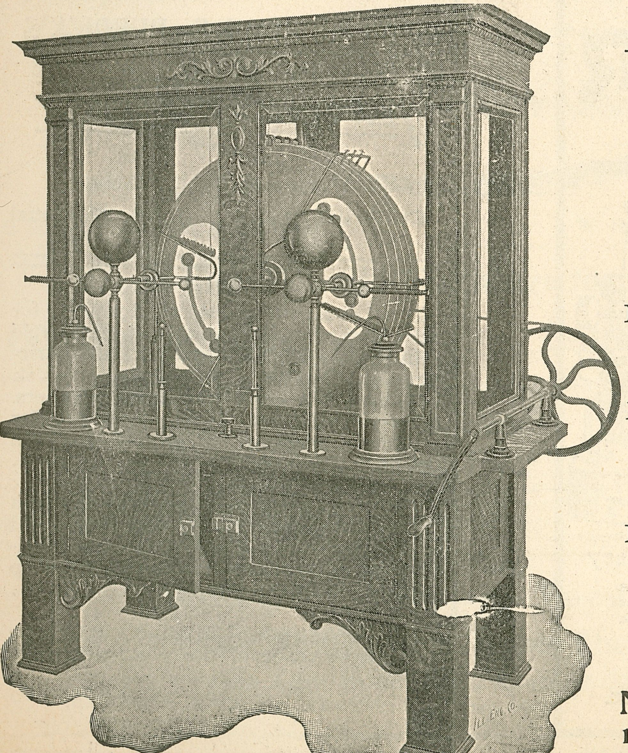

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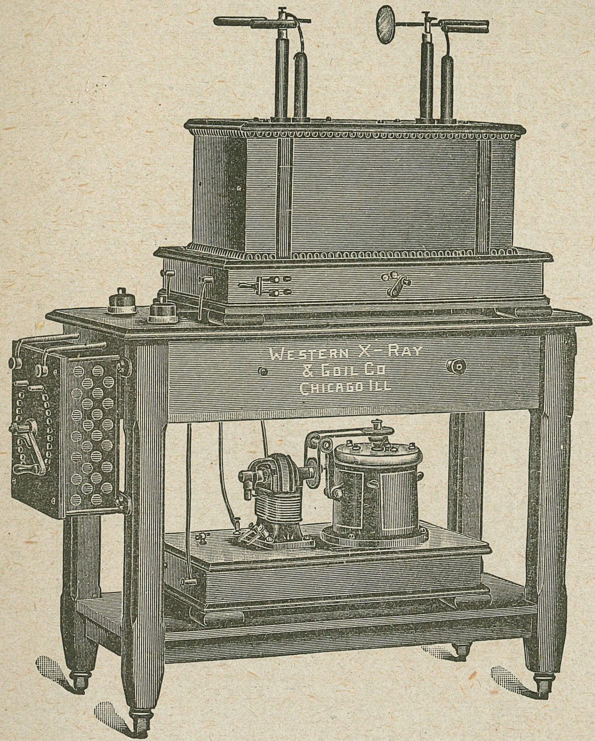
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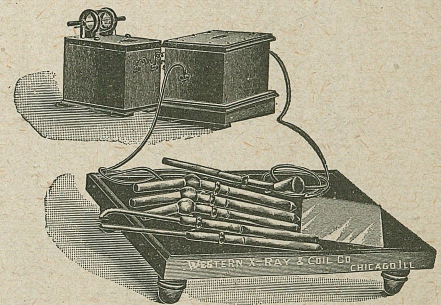
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